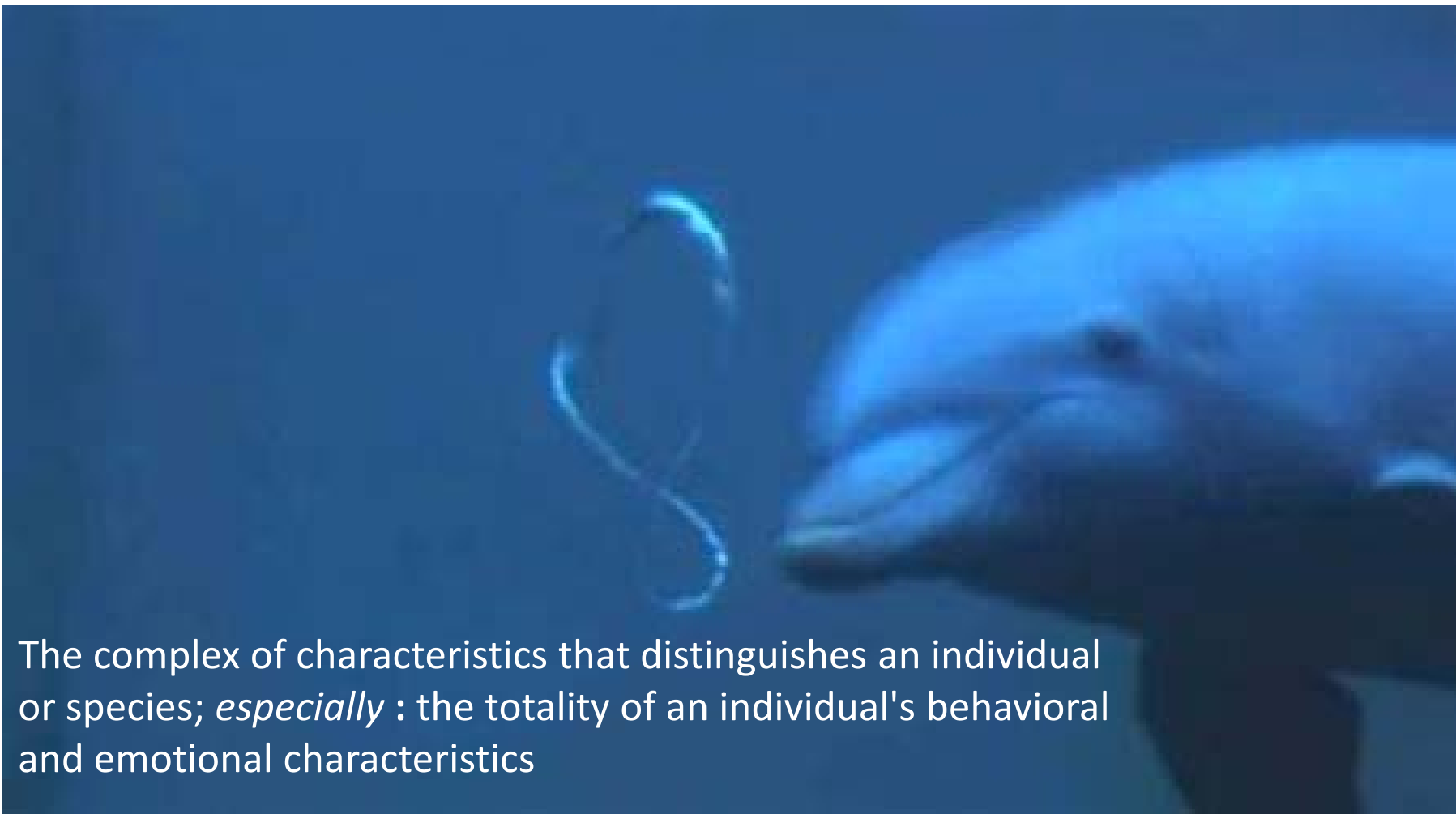


Animal Personality



The complex of characteristics that distinguishes an individual or species; *especially* : the totality of an individual's behavioral and emotional characteristics

Animal Personality

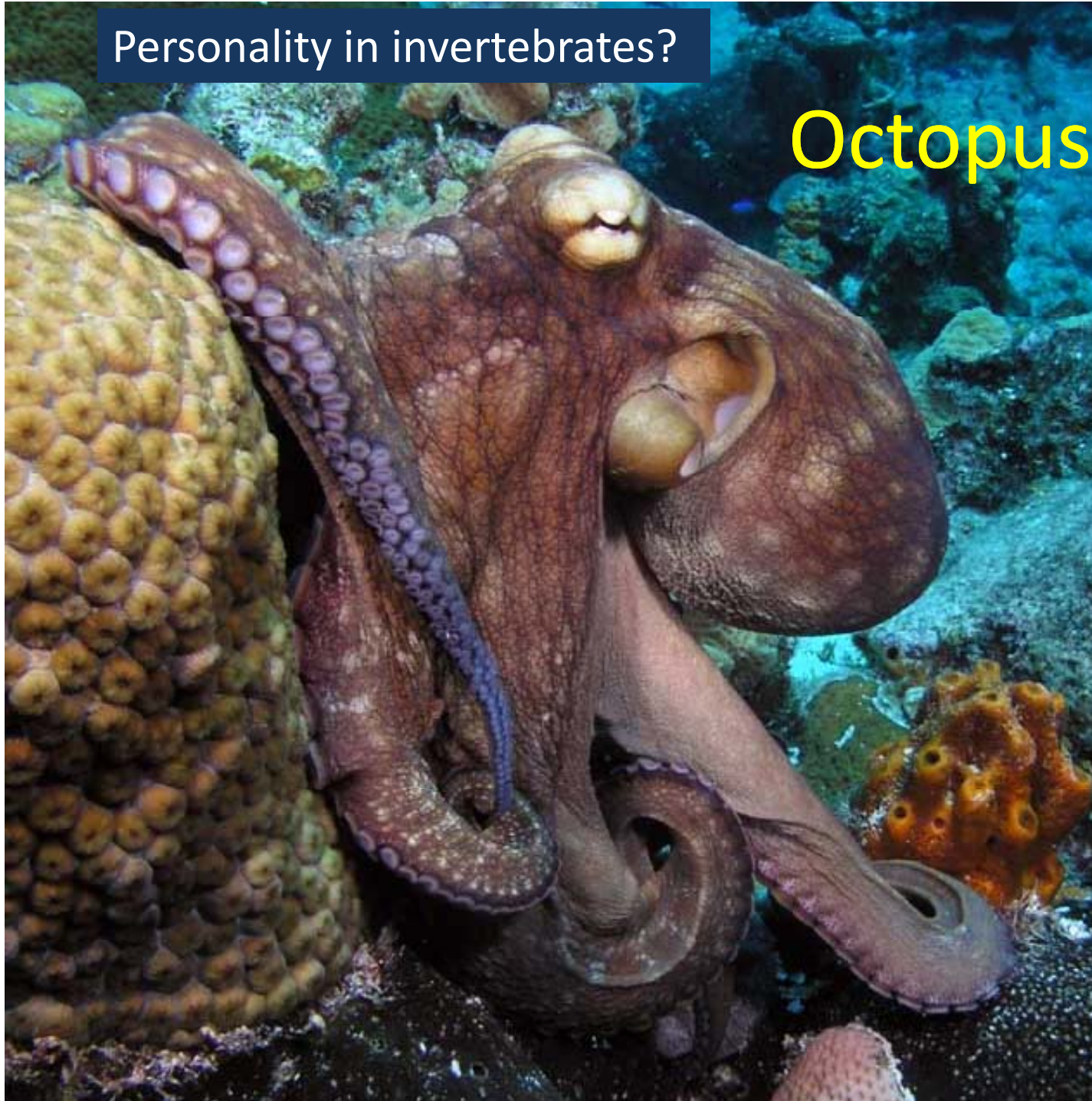
Particular combination of emotional, attitudinal, behavioral response pattern of an individual

The four humours

Humour	Season	Element	Organ	Qualities	Ancient name	Modern	Ancient characteristics
Blood	spring	air	liver	warm & moist	sanguine	artisan	Scourageous, hopeful, happy, generous
Yellow bile	summer	fire	gall bladder	warm & dry	choleric	idealist	Measily angered, short-tempered, violent
Black bile	autumn	earth	spleen	cold & dry	melancholic	guardian	Sdespondent, Jsleepless, sentimental
Phlegm	winter	water	brain/lung	cold & moist	phlegmatic	rational	Mcalm, unemotional Tcowardly

Personality in invertebrates?

Octopus



Octopus personality

- Active vs. inactive
- Aggressive vs. shy
- Anxious vs. calm

Journal of Comparative Psychology
1993, Vol. 107, No. 3, 336–340

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0735-7035/93/070336-05\$05.00

Personalities of Octopuses (*Octopus rubescens*)

Jennifer A. Mather and Roland C. Anderson

Large individual differences are commonly found in the behavior of octopuses, even in standardized situations. *Octopus rubescens* ($n = 44$) were tested in 3 situations (alerting, threat, and feeding) to quantify this variation. A factor analysis of resulting behaviors isolated 3 orthogonal dimensions of their variability, Activity, Reactivity, and Avoidance, which accounted for 45% of the variance. The similarity of these factors to dimensions of personality in humans and individual differences in animals suggests there may be commonalities in such variation across phyla.

How did scientists quantify the octopus personality?

Table 1

Measures of the Response of Individual Octopus rubescens (n = 44) in Tests of Alerting, Threat, and Feeding

Behavior	$M \pm SD$	Coefficient of variation	Definition
Alerting test			
Eyes open	6.85 ± 0.66	0.10	Subject's pupils are enlarged
In den	2.08 ± 2.82	1.35	Subject stays within shelter
At rest	4.65 ± 2.37	0.51	Subject's body is low, with arms raised above head
Color change	0.38 ± 0.77	2.02	Subject's overall skin color pattern is changed
Head bob	1.73 ± 1.54	0.89	Subject makes vertical movement of the head
Move	1.10 ± 1.15	1.04	Subject changes location
Shrink	0.28 ± 0.51	1.82	Subject increases distance from observer
Threat test			
Shrink	5.18 ± 1.67	0.40	Subject increases distance from threat
Squirt	4.15 ± 1.72	0.41	Subject jets water through funnel at threat
Crawl	1.70 ± 1.16	0.68	Subject moves on tank bottom from threat
Ink	0.08 ± 0.35	4.38	Subject releases camouflaging ink into water
In den	0.48 ± 0.96	2.00	Subject stays within shelter
Grasp	2.68 ± 2.68	1.00	Subject grasps threatening object with arms
Swim	1.65 ± 1.68	1.02	Subjects moves by jet propulsion from threat
Feeding test			
In den	0.78 ± 1.12	1.44	Subject stays within shelter
Alert	2.48 ± 1.88	0.76	Subject raises head, with arms down
Head bob	1.40 ± 1.46	1.04	Subject makes vertical movement of the head
Capture technique ^a	2.44 ± 0.44	0.18	Subject approaches prey
Papillae change	2.36 ± 0.64	0.27	Subject raises skin surface in papillae

Good example of how you write your project report to quantify behavior

Great tit's personality

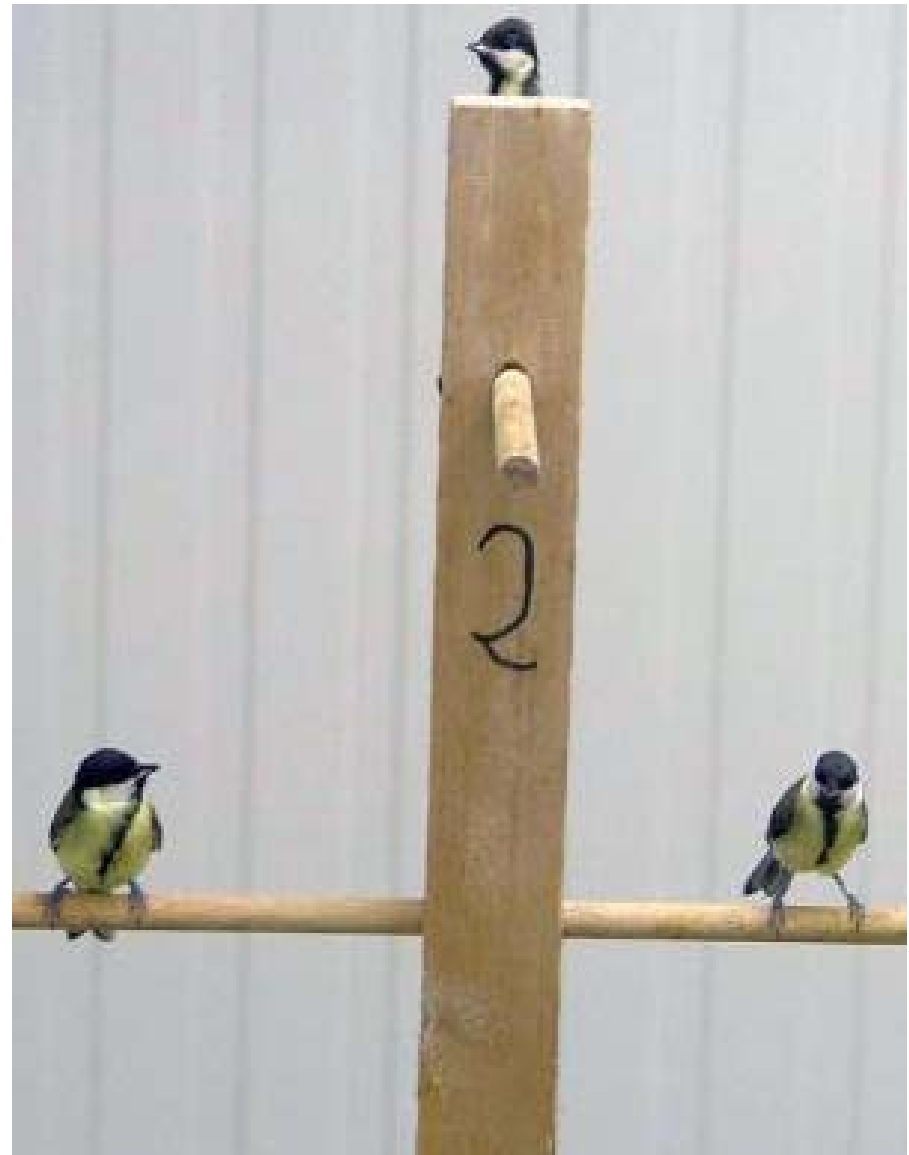


Great tit's personality

1. Why hasn't one personality become the standard in the population?
2. What are the advantages of using the great tit as animal model for the study of personality?
3. What are the experiments in this article to test and measure the personality of the great tit?

Measure Personality- first to explore

1. measured the time until a bird had visited four artificial "trees" after being released in the observation room.



Measure Personality- first to approach novel objects

1. Quantified the reaction of the bird towards each of two unknown objects that had been put in its cage. One such novel object was a pink panther.



Great tits



"Fast" birds

- Aggressive
- Approach novel objects
- Quickly approach members of the opposite sex



"Slow" birds

- Nonaggressive
- Avoid novel objects
- Slowly approach members of the opposite sex

Why hasn't one personality become the standard in the population?

Which personality is the best one for survival in great tits?
difference in sexes?

1. Depending on ecological situation (food availability)
2. Depending on what other birds do:
game theory: hawk/dove game
3. Intermediate personality seems to be better



Game theory- hawk/ dove game

Player 1 (animal 1)

Hawk

Dove

Player 2 (animal 2)

Hawk

$$(v - c)/2$$

$$v$$

Dove

$$0$$

$$v / 2$$

***Drd4* gene polymorphisms are associated with personality variation in a passerine bird**

Andrew E. Fidler^{1,2,†}, Kees van Oers^{1,3,†}, Piet J. Drent³, Sylvia Kuhn¹,
Jakob C. Mueller¹ and Bart Kempenaers^{1,*}

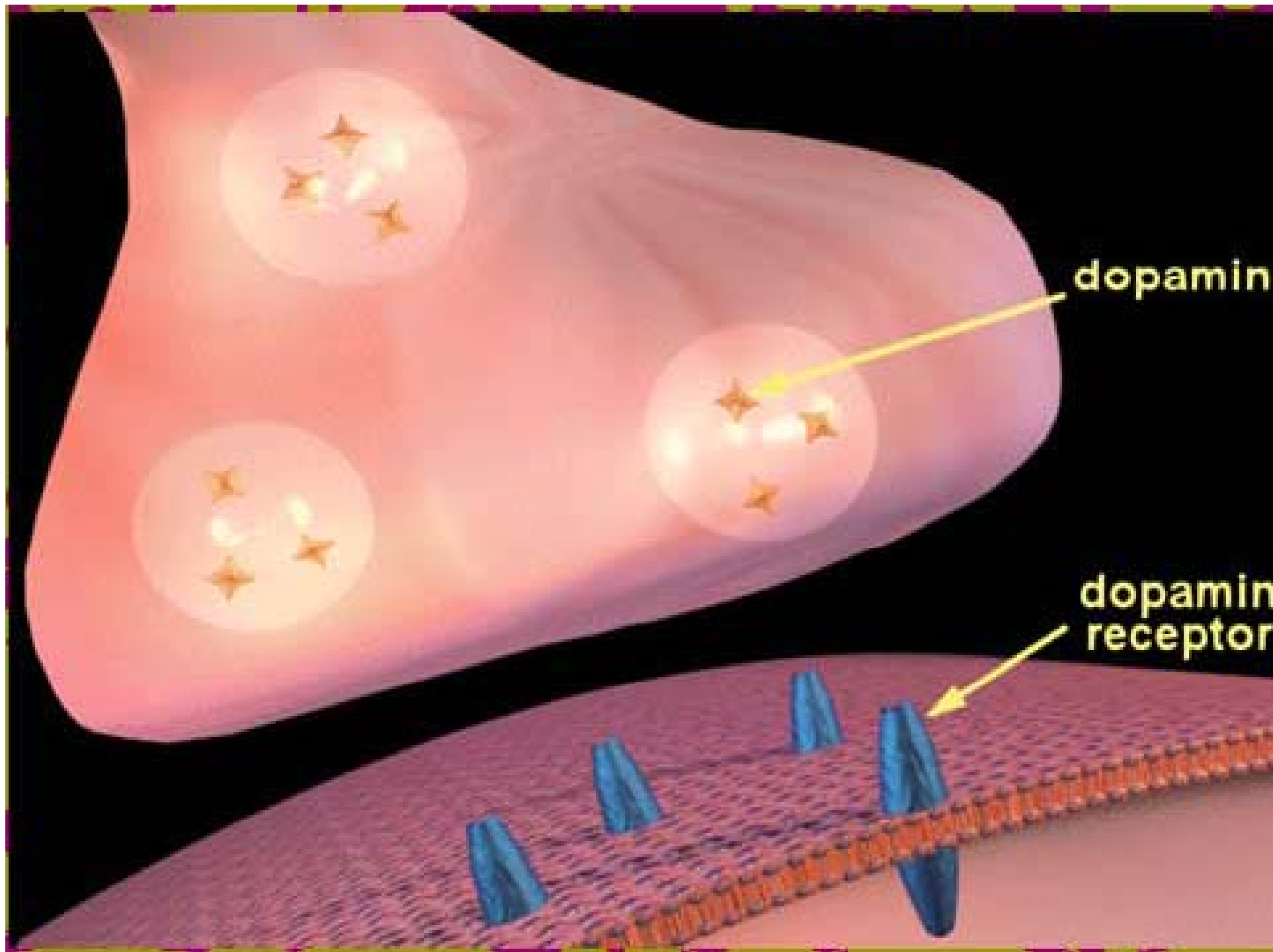
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Personality
Vs.
DRD4





Personality in great tits

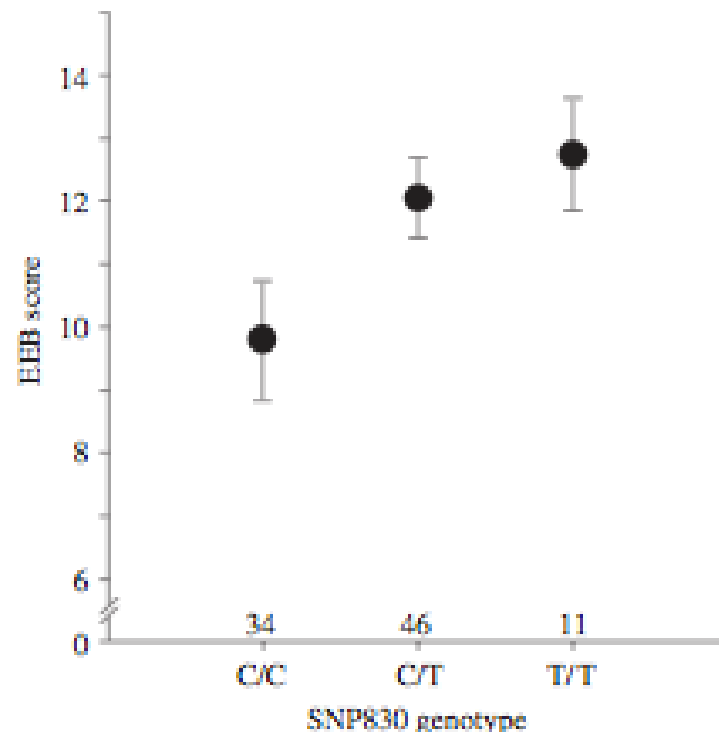
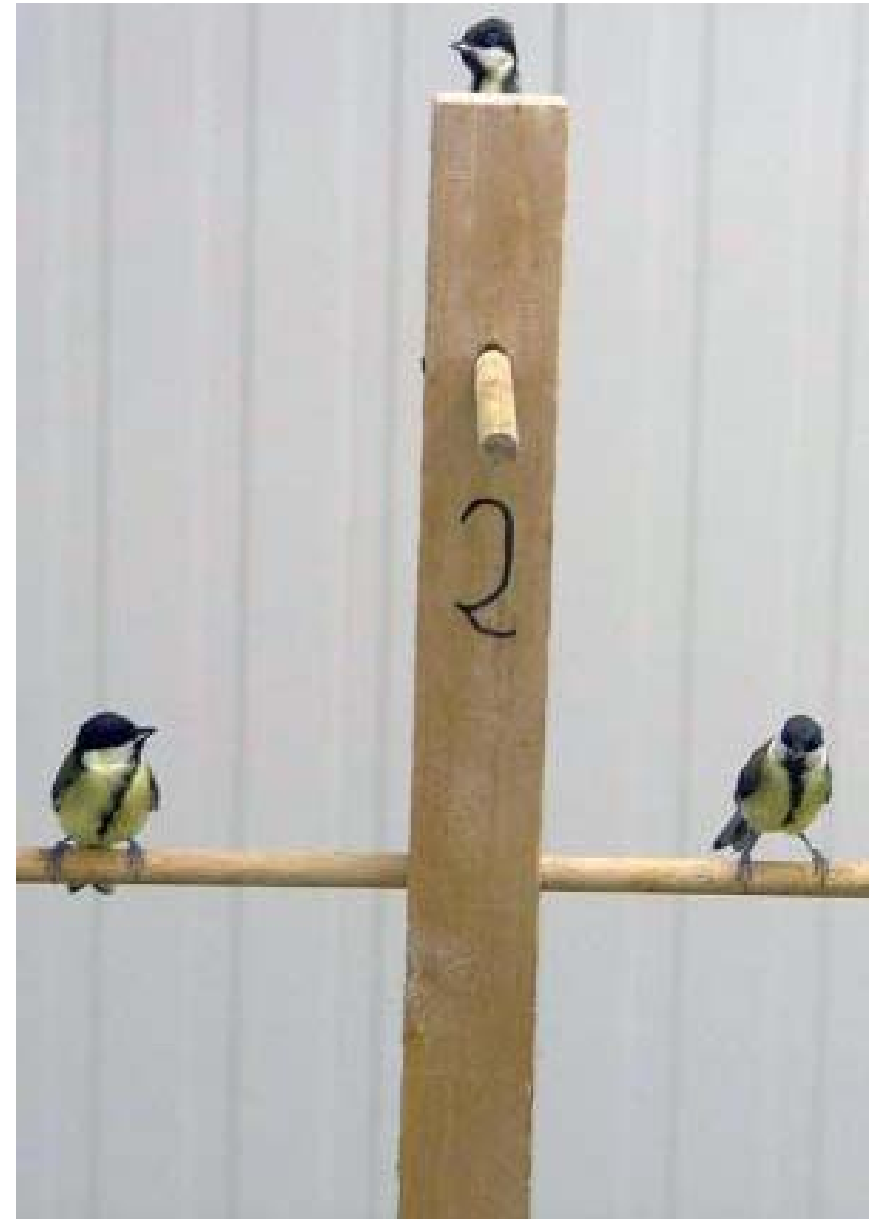


Figure 2. EEB scores of unselected birds genotyped for the *Drd4* SNP830 polymorphism. Data shown are mean EEB values \pm s.e.m.; sample sizes are indicated above the x-axis and refer to the total number of individuals including offspring from the same brood. Note that the statistical analysis (mixed-effects models) controls for the presence of these siblings (see text for details). The most prominent difference in EEB scores is between the SNP830C/C birds and the other two genotypes, indicating a partially dominant effect of the SNP830T allele. Overall, EEB score differed significantly among SNP830 genotypes in both the effect trend model ($p=0.038$) and the dominant effect model with SNP830T as the dominant allele ($p=0.030$).



Personality and DRD4 variants

1. Songbirds
2. Chickens
3. Horses
4. Dogs
5. Humans

DRD4 and human personality

Association of the Dopamine D4 Receptor (*DRD4*) Gene and Approach-Related Personality Traits: Meta-Analysis and New Data

Marcus R. Munafò, Binnaz Yalcin, Saffron A. Willis-Owen, and Jonathan Flint

Background: Two variants in the dopamine D4 receptor (*DRD4*) gene have been reported to be associated with human approach-related traits such as novelty seeking and extraversion. However, the strength of evidence for this association remains uncertain.

Methods: We conducted a meta-analysis of published studies of the association between the *DRD4* gene variable number of tandem repeats (VNTR) and C-521T polymorphisms and human approach-related personality traits, including novelty seeking, extraversion, and impulsivity, restricted to adult samples recruited from nonpsychiatric populations, and extended on this literature by attempting to confirm any evidence of association in a replication sample ($n = 309$) selected for extreme scores on the extraversion subscale of the Eysenck Personality Questionnaire from a large ($n = 40,090$) population-based sample.

Results: Our initial meta-analysis supported the association of the *DRD4* C-521T polymorphism, but not the VNTR polymorphism, with approach-related traits. This conclusion was qualified by evidence of significant publication bias and the failure to detect association in a replication sample comprising individuals at the extremes of the trait distribution. The association of the C-521T polymorphism observed in our initial meta-analysis was robust to the inclusion of these new data, but our revised meta-analysis indicated that the association was present for measures of novelty seeking and impulsivity but not for measures of extraversion.

Conclusions: The *DRD4* gene may be associated with measures of novelty seeking and impulsivity but not extraversion. The association of the C-521T variant with these measures, if genuine, may account for up to 3% of phenotypic variance.

DRD4 tandem repeat

Individual differences in DNA Repeats Polymorphism

Longer gene_ more repeats

```
1 aatTTTtGta tTTTtTtag agacgggggtt tcaccatggtt ggtcagggtg actatggagt
61 tattTTaagg ttaatatata taaagggtat gatagaacac ttgtcatagt ttagaacgaa
121 ctaacgatag atagatagat agatagatag atagatagat agatagatag atagacagat
181 tgatagTTTT tTTtatctc actaaatagt ctatagtaaa catttaatta ccaatatttg
241 gtgcaattct gtcaatgagg ataaatgtgg aatcggtata attcttaaga atatatattc
301 cctctgagtt ttgataacct cagattttaa ggcc
```

Shorter gene_ less repeats

```
1 aatTTTtGta tTTTtTtag agacgggggtt tcaccatggtt ggtcagggtg actatggagt
61 tattTTaagg ttaatatata taaagggtat gatagaacac ttgtcatagt ttagaacgaa
121 ctaacgatag atagatagat agatagatag atagatagat agTTTTTT tatctcacta
181 aatagt ctatagtaaa catttaatta ccaatatttg gtgcaattct gtcaatgagg
241 ataaatgtgg aatcggtata attcttaaga atatatattc cctctgagtt ttgat
301 acct cagattttaa ggcc
```

2-11 repeats in DRD4

Associations between Dopamine D4 Receptor Gene Variation with Both Infidelity and Sexual Promiscuity

Justin R. Garcia^{1,2,3,4,*}, James MacKillop^{5,6}, Edward L. Allen^{1,2}, Ann M. Merriwether^{4,7,8}, David Sloan Wilson^{2,3,4}, J. Koji Lum^{1,2,3,4}

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Abstract

Background: Human sexual behavior is highly variable both within and between populations. While sex-related characteristics and sexual behavior are central to evolutionary theory (sexual selection), little is known about the genetic bases of individual variation in sexual behavior. The variable number tandem repeats (VNTR) polymorphism in exon III of the human dopamine D4 receptor gene (DRD4) has been correlated with an array of behavioral phenotypes and may be predictively responsible for variation in motivating some sexual behaviors, particularly promiscuity and infidelity.

Methodology/Principal Findings: We administered an anonymous survey on personal history of sexual behavior and intimate relationships to 181 young adults. We also collected buccal wash samples and genotyped the DRD4 VNTR. Here we show that individuals with at least one 7-repeat allele (7R+) report a greater categorical rate of promiscuous sexual behavior (i.e., having ever had a "one-night stand") and report a more than 50% increase in instances of sexual infidelity.

Conclusions/Significance: DRD4 VNTR genotype varies considerably within and among populations and has been subject to relatively recent, local selective pressures. Individual differences in sexual behavior are likely partially mediated by individual genetic variation in genes coding for motivation and reward in the brain. Conceptualizing these findings in terms of *r/K* selection theory suggests a mechanism for selective pressure for and against the 7R+ genotype that may explain the considerable global allelic variation for this polymorphism.

Citation: Garcia JR, MacKillop J, Allen EL, Merriwether AM, Wilson DS, et al. (2010) Associations between Dopamine D4 Receptor Gene Variation with Both Infidelity and Sexual Promiscuity. PLoS ONE 5(11): e14162. doi:10.1371/journal.pone.0014162

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The 7R polymorphism in the dopamine receptor D₄ gene (*DRD4*) is associated with financial risk taking in men[☆]

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Initial receipt 20 September 2008; final revision received 11 November 2008

Abstract

Individuals exhibit substantial heterogeneity in financial risk aversion. Recent work on twins demonstrated that some variation is influenced by individual heritable differences. Despite this, there has been no study investigating possible genetic loci associated with financial risk taking in healthy individuals. Here, we examined whether there is an association between financial risk preferences, elicited experimentally in a game with real monetary payoffs, and the presence of the 7-repeat allele (7R+) in the dopamine receptor D₄ gene as well as the presence of the A1 allele (A1+) in the dopamine receptor D₂ gene in 94 young men. Although we found no association between the A1 allele and risk preferences, we did find that 7R+ men are significantly more risk loving than 7R– men. This polymorphism accounts for roughly 20% of the heritable variation in financial risk taking. We suggest that selection for the 7R allele may be for a behavioral phenotype associated with risk taking. This is consistent with previous evolutionary explanations suggesting that selection for this allele was for behaviors associated with migration and male competition, both of which entail an element of risk.

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Further study: 2010

DRD4 gene : political ideology

?

Political ideology is thought to be a product of social environment and historical moment, but.....

DRD4 gene : political ideology

Friendships Moderate an Association between a Dopamine Gene Variant and Political Ideology

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Christopher T. Dawes University of California, San Diego
Nicholas A. Christakis Harvard University
James H. Fowler University of California, San Diego

Scholars in many fields have long noted the importance of social context in the development of political ideology. Recent work suggests that political ideology also has a heritable component, but no specific gene variant or combination of variants associated with political ideology have so far been identified. Here, we hypothesize that individuals with a genetic predisposition toward seeking out new experiences will tend to be more liberal, but only if they are embedded in a social context that provides them with multiple points of view. Using data from the National Longitudinal Study of Adolescent Health, we test this hypothesis by investigating an association between self-reported political ideology and the 7R variant of the dopamine receptor D4 gene (DRD4), which has previously been associated with novelty seeking. **Among those with DRD4-7R, we find that the number of friendships a person has in adolescence is significantly associated with liberal political ideology.** Among those without the gene variant, there is no association. This is the first study to elaborate a specific gene-environment interaction that contributes to ideological self-identification, and it highlights the importance of incorporating both nature and nurture into the study of political preferences.

NEW YORK STATE

David J. Swarts
Commissioner of Motor Vehicles



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ISSUED: 09-30-08

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Genomic information
DRD4
Vassopressin
Cry2
GR (methylation)
Breast Cancer genes
Alzheimer's genes
Htt

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Is our personality determined
by DRD4 gene?

Of course not, personality is
only partially
determined by genes

Novelty seeking is 30% heritable

- And there are hundreds of genes associated with this novelty seeking behavior
- * Environment still has a critical effect

Shy baby monkeys are fostered to confident mother monkey, they can outgrow their shyness even become the leader of a group.



Personality might be related to morphological traits

Genes that are associated with a specific behavioral trait often times are also associated with other morphological or physiological traits.



Study of a European population

Shy people (study of a European population) are more likely to be blue-eyed, susceptible to allergies, tall and thin, narrow-faced, faster hearbeat.

Ultimate causes of animal personality

- Evolving different personality is beneficial to individual's survival or reproductive success.

Game theory: play hawk or dove...

“novelty-seeking” , “curious”, “cautious”, or “shy” are all evolutionary stable strategy.

Proximate causes of animal personality

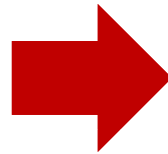
- Genetic basis of animal personality:
DRD4 gene (and many others): partially determine animal personality across many animal species.

Social influence also plays an important role on the development of personality
- Study of animal **domestication** may shed light about the development of personality and its evolution.

Domestication induces changes in personality/morphology



Wolf



Dog

How did it happen?

Darwin noticed that domesticated animals shared many characters that are not observed in their relatives in the wild

appearance of dwarf and giant varieties	all
piebald coat color	all
wavy or curly hair	sheep, poodles, donkeys, horses, pigs goats, mice, guinea pigs
rolled tails	dogs, pigs
shortened tails, fewer vertebrae	dogs, cats, sheep
floppy ears	dogs, cats, pigs, horses, sheep, goats, cattle
changes in reproductive cycle	all except sheep

Many domestic animals shared traits:

1. Wavy, curly hairs
2. Piebald coat color
3. Curly, circle tails
4. Floppy ears
5. Loss of seasonal reproduction
6. Tame

Selective breeding for
each one of above traits?



Domesticate /tame foxes



Silver fox

Dmitry Belyaev's Hypothesis of animal domestication



Selective breeding of *tamability*

How is tamability selected and scored?

When a pup is one month old, an experimenter offers it food from her hand while trying to stroke and handle the pup.

Class III: The least domesticated foxes, flee from experimenters or bite when stroked or handled,

Class II: let themselves be petted and handled but show no emotionally friendly response to experimenters.

Class I: are friendly toward experimenters, wagging their tails and whining.

Class IE: (after 6th generation) are eager to establish human contact, whimpering to attract attention and sniffing and licking experimenters like dogs.

Domestication of foxes

genetics or environments?

- Is it possible to domesticate foxes in one generation? No! environment is not sufficient
- It takes 3 generations of selective breeding to see behavioral changes in silver foxes (tamer).
- In 10 generations, start seeing morphological changes (fur color), curly tails, barking....
- In 35-40 generations, many individuals behave like domesticated dogs or cats.
- Genetics must play an important role on during the domestication

Belyaev's selective breeding program



50 years (35-40 generations)
→ 50,000 foxes

Domestic silver fox

“.....as devoted as dogs but as independent as cats, capable of forming deep-rooted pair bonds with human beings.”



What have changed in the foxes over many years of selective breeding of tamability?

1. Floppy ears, curled tails
2. Patches of white fur (coat color)
3. Lost musky fox smell
4. Smaller, feminized skull, like juveniles.
5. Barking, wagging tails, licking humans
6. Reduce fear response and corticosteroid

Domestication of foxes



How did it happen?

Selective breeding: the tamest animals

Selective breeding: the tamest animals why coat color changes?

Select the tamest animals (genetics)



Animals have less and less adrenaline hormone
(become less aggressive)



Animals have less and less melanin hormone
(melanin controls coat color)



Other hormones are affected as well

Great differences in behavioral,
morphological, and physiological traits
between domesticated and wild foxes
big difference in genomic sequence?

However, there is >99% similarity in genomic sequence
between domesticated and wild foxes, how do such
behavioral/ morphological differences come from?

>99% similarity in genomic sequence
between domesticated and wild foxes,
But so much difference in behavior
between these two, why?

Not much difference in the number of genes,

But great difference in how genes are regulated
(or, expression of the genes):

When

Where specific (groups of) genes turn on/off

What

Take-home message

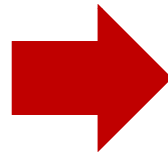
Behavioral traits (personality) are closely associated with other morphological or physiological traits.

Pleiotrophy: the same set of genes can affect multiple traits

Domestication induces changes in personality/morphology



Wolf



Dog

How did it happen?

Selective breeding: the tamest animals

Are we humans in the process of self-domestication?

Study of a European population

Shy people (study of a European population) are more likely to be blue-eyed, susceptible to allergies, tall and thin, narrow-faced, faster heartbeat.

